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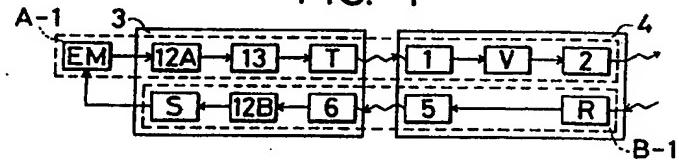
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(54) Improvements in or relating to
wireless transmitting and receiving
systems including ear microphones

(57) There is provided a wireless
transmitting and receiving system
including an ear microphone EM of
vibration pick-up type for picking up
bone-conducted voice signals through
an external auditory canal wall of a
wearer. A portable case 3, for instance

of ear hanging type, is disposed
adjacent the wearer's ear and a
wireless means 4 is attached to the
wearer's body. The portable case
houses a transmitter T of a
transmitting line A—1 for transmitting
the output signals of the ear
microphone EM. A receiver R of a
receiving line B—1 is housed in the
wireless means and receives signals
from the exterior.

FIG. 1



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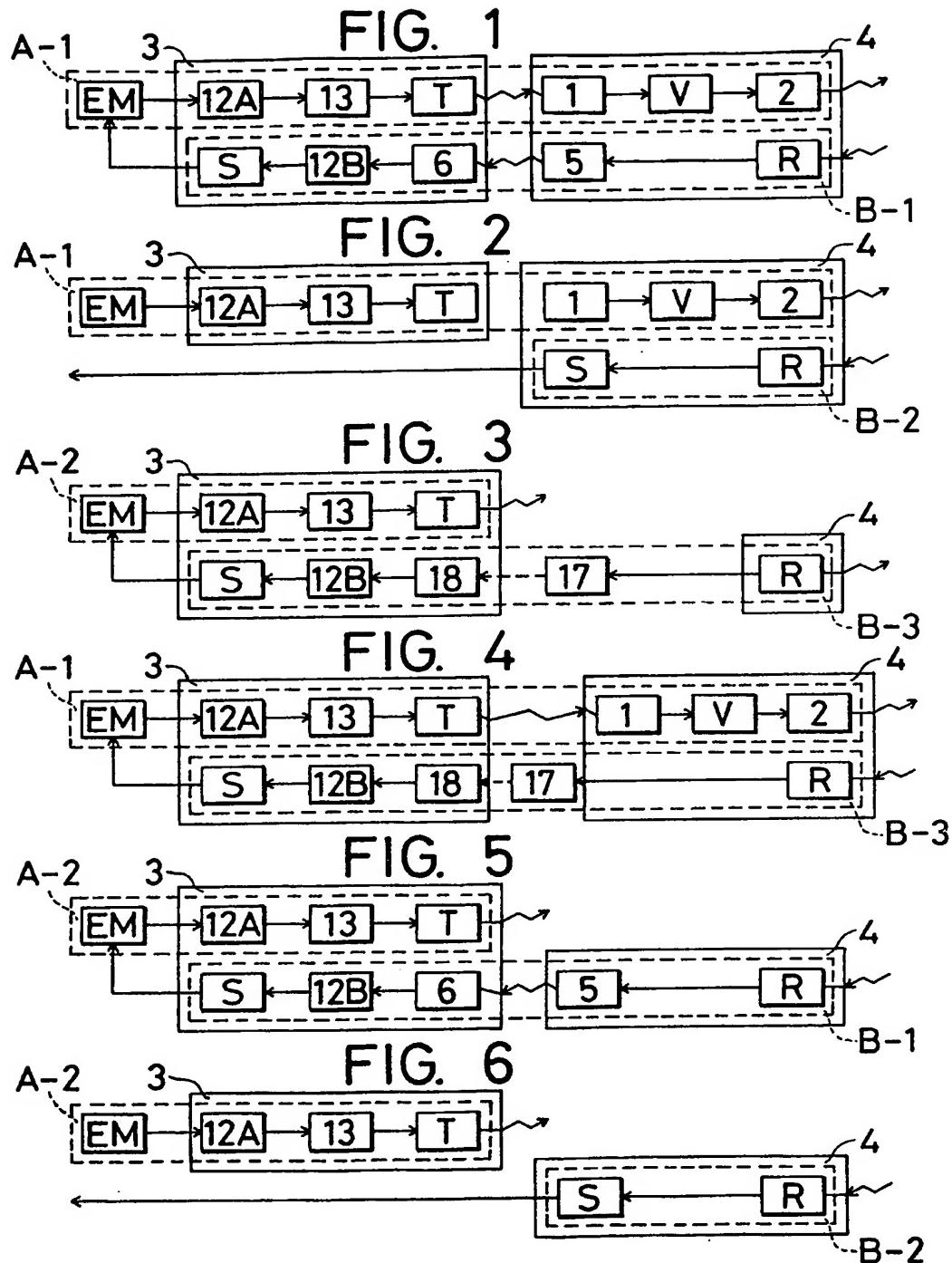


FIG. 7

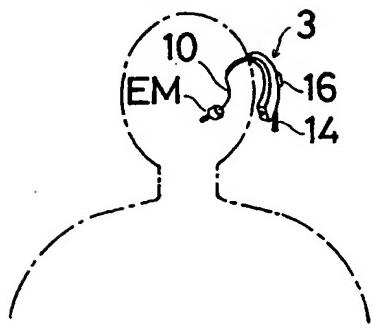


FIG. 8

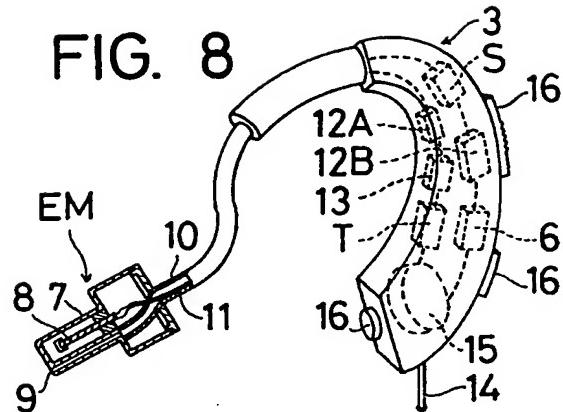


FIG. 9

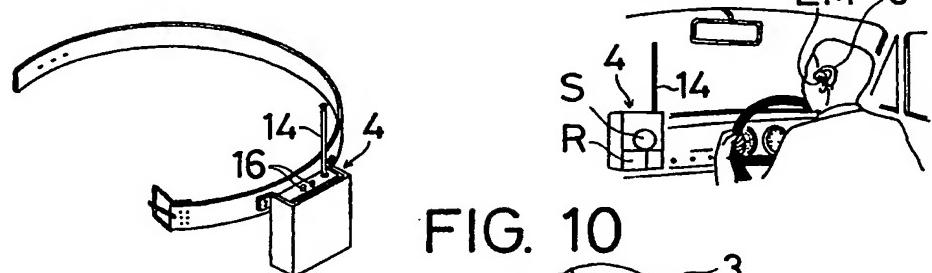


FIG. 10

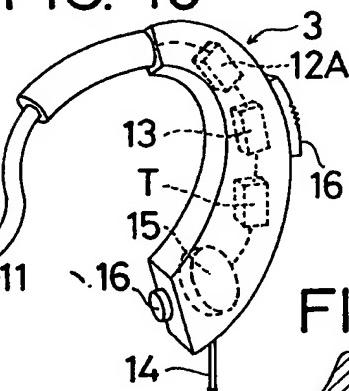


FIG. 11

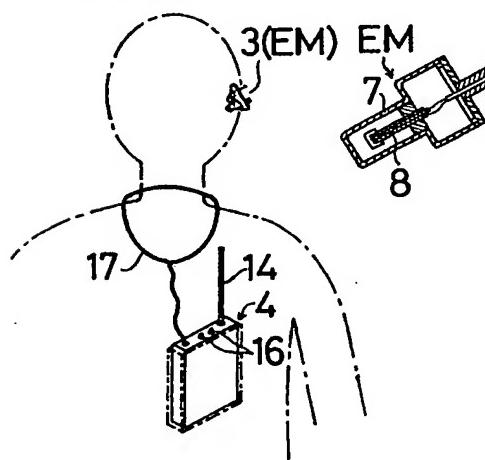
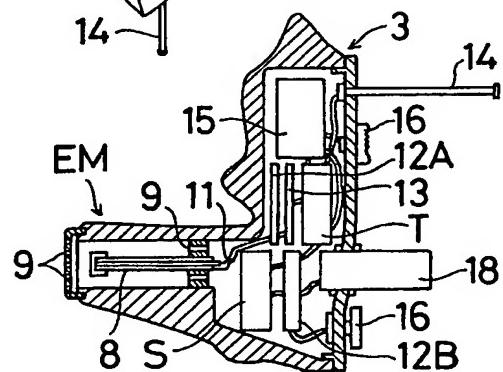


FIG. 12



SPECIFICATION

Improvements in or relating to wireless transmitting and receiving systems including ear microphones.

- 5 The present Invention relates to a wireless transmitting and receiving system including an ear microphone of vibration pick-up type. Such a system may be of the type in which both transmitting and receiving lines comprise an ear
 10 microphone and a speaker, respectively, and are wireless with transmission and reception being attained through one ear of an ear microphone wearer.
 An ear microphone of vibration pick-up type
 15 (which is hereinafter referred to as ear mic) may be fitted into the external auditory canal of one ear wearer to pick up the voice signals (or vibrations) conducted through his bones in the external auditory canal wall. An ear mic as described above,
 20 has been publicly disclosed by Hiroshi Ono, and 1,532,493, and can be combined with a speaker such as the usual earphone of sound pressure type.
 It has been arranged to transmit and receive
 25 through a wireless system (of electromagnetic induction type) using the ear mic as the transmitting line and a speaker as the receiving line. In this system, a lead wire for supplying the output of the ear mic was connected to the usual
 30 wireless means such as a two way radio, a cord of the sound pressure type earphone was connected to the same wireless means, the sound pressure type earphone was connected to the ear mic, and the ear mic provided with the ear phone was fitted
 35 into the external auditory canal of one ear of the wearer. As a result, though wireless communication of transmission and reception was achieved, the noises of the lead wire and cord extending from the ear mic provided with the
 40 earphone were picked up by the ear mic because the ear mic was of vibration pick-up type. Thus, It was found that the cord noises wirelessly transmitted made obscure the voice transmitted sound. In addition, the lead wire and cord connecting the ear mic provided with the
 45 earphone and fitted into the external auditory canal of one ear of the wearer to the wireless means attached to the waist or the like of the wearer hindered free movement of the wearer.
 50 According to the invention, there is provided a wireless transmitting and receiving system comprising an ear microphone of vibration pick-up type for picking-up bone-conducted voice signals through the external auditory canal wall of an ear
 55 microphone wearer, a portable case arranged to be disposed adjacent an ear of the wearer, and a wireless means for attachment to the body of the wearer, the device comprising a transmitting line including a transmitter for transmitting output
 60 signals of the ear microphone and being housed in the portable case, and a receiving line including a receiver for receiving signals transmitted from the outside housed in the wireless means, the transmitting and receiving lines providing wireless

- 65 connection between the portable case and the wireless means, whereby communication comprising transmission and reception may be achieved through one ear of the wearer into which the ear microphone is inserted.
 70 According to preferred embodiments of the invention it is possible to provide a wireless transmitting and receiving system using an ear mic capable of meeting the following requirements:
 75 (1) By using the ear mic in the transmitting line, noises can be excluded and clear voice sounds can be transmitted when used under highly noisy circumstances;
 (2) By combining the ear mic with a speaker of
 80 the receiving line, transmission and reception can be achieved through at least one ear of the wearer leaving his hands free for doing anything he wants;
 (3) By employing in the transmitting and receiving lines a wireless system, the ear mic can avoid picking up cord noises;
 (4) By using a wireless system, the wearer is allowed to move freely, for example the driver in a car in which the wireless system is provided can
 90 drive the car feeling no limitation to his movement, such car for instance being a wireless communication car, a patrol car, or a telephone car, and works with part of the wireless system attached to their waists are allowed to do their
 95 work freely while communicating with each other for instance on a construction site;
 (5) The wireless system may use a conventional FM transmitter, receiver, transceiver, CB set, two way radio or the like, which are readily available;
 100 (6) During the operation of transmission and reception either of the ears of the wearer may be left open to hear sounds from outside, thus improving security to the wearer.
 A preferred embodiment of the present
 105 invention comprises an ear microphone of vibration pick-up type for picking up the bone-conducted voice signals through the external auditory canal wall, a speaker through which the signals transmitted from outside are heard, a
 110 portable case attached to around the ear of an ear microphone wearer, and a wireless means attached to the body of the ear microphone wearer, wherein a transmitter of the transmitting line for transmitting the output signals of the ear
 115 microphone is housed in the portable case, a receiver of the receiving line for receiving the signals transmitted from outside is housed in the wireless means, and other parts of transmitting and receiving lines are housed in the portable case
 120 and the wireless means, respectively, transmission and reception are wirelessly-attained between the portable case and wireless means, and the communication of transmission and reception is performed through one ear of the wearer into which the ear microphone is fitted.
 125

The present invention will be further described, by way of example, with reference to the accompanying drawings, in which like reference numerals refer to like parts, and in which:

Figures 1 to 6 are block diagrams showing respective embodiments of the present invention;

Figure 7 is a perspective view of the embodiment of Figure 1 showing the condition under which a portable transmitting and receiving case and wireless means are attached to the ear and the waist band of the wearer, respectively;

Figure 8 is a perspective view, partly cut away, of a portable transmitting and receiving case of ear hanging type shown in Figure 7;

Figure 9 is a perspective view of the embodiment of Figure 2 showing how a portable transmitting case of ear hanging type and wireless means are arranged in a car;

Figure 10 is a perspective view, partly cut away, of the portable transmitting case of ear hanging type shown in Figure 9;

Figure 11 is a perspective view of the embodiment of Figure 3 showing the condition under which a portable transmitting and receiving case is fitted into an external auditory canal and wireless means provided with a loop antenna is housed in a breast pocket of the wearer;

Figure 12 is a sectional view of the portable transmitting and receiving case shown in Figure 11.

As shown in Figures 1, 7 and 8, a transmitting circuit A-1 comprises a transmitter T, a receiver 1

for receiving signals transmitted from the transmitter T, and a second transmitter 2 for external transmission of the output signals of the receiver 1. The transmitter T is housed in a portable ear hanging case 3, and the receiver 1 and the second transmitter 2 are housed in a wireless means 4.

A receiving line B-1 comprises a receiver R, a transmitter 5 for transmitting output signals of the receiver R, a second receiver 6 for receiving the signals transmitted from the transmitter 5, and a speaker S for acoustically converting the output signals of the second receiver 6 and supplying them as outputs. The receiver R and the transmitter 5 are housed in the wireless means 4 and the second receiver 6 and speaker S are housed in the ear hanging portable case 3.

An ear microphone EM comprises a microphone body 7 loosely inserted into the external auditory canal so as not to cause a blocking effect of the canal, a vibration pick-up element 8 such as a piezo-electric element supported by the body 7, and a sound passage 9.

The microphone body 7 is connected to the ear hanging portable case 3 through a sound tube 10, which serves to introduce the outputs of the sound pressure type speaker S to the microphone body 7. The sound tube 10 contains therein a lead wire 11 for supplying the electrical output of the pick-up element 8.

In the Figures, numerals 12A and 12B

represent amplifiers, 13 an FM modulator, 14 an antenna, 15 a power source, 16 a switch and V a voice-operated controller. The wireless means 4 used in this embodiment may comprise a conventional two way radio combined with the receiver and transmitter.

Bone-conducted voice signals picked up by the ear mic (EM) are supplied through the lead wire 11 and are amplified by the amplifier 12A, and then FM-modulated by the FM modulator 13, and

70 are transmitted by the transmitter T. The transmitted signals are received by the receiver 1 and transmitted externally by the second transmitter 2. The signals transmitted from outside are received by the receiver R and again

75 transmitted by the transmitter 5. The transmitted signals of the receiving line are received by the second receiver 6, amplified by the amplifier 12B and acoustically converted by the speaker S. The sounds thus produced are introduced through the sound tube 10 to the mic body 7 and are heard through the sound passage 9.

In the embodiment shown in Figures 2, 9 and 10, the transmitting line A-1 is the same as that of the embodiment of Figure 1. A receiving line B-2

85 includes a receiver R housed in the wireless means 4 and a speaker S for acoustically converting the output signals of the receiver R. The output sounds are heard through the ear into which the ear microphone EM is inserted and the other ear of the wearer. The wireless means 4 used in this embodiment may be a conventional CB (citizen's band) set combined with the receiver.

In the embodiment shown in Figure 3, 11 and 12, the transmitting line is housed in a portable

95 case, which is inserted into the external auditory canal, and includes a transmitter T for transmitting to the outside the output signal of the ear mic EM. The receiving line B-3 comprises a receiver R, a loop antenna 17 for electromagnetically inducing

100 output signals of the receiver R, and induction coil 18 electromagnetically coupled to the loop antenna 17, and a speaker S for acoustically converting the output signals of the induction coil 18. The receiver is housed in the wireless means

105 4, the loop antenna 17 connected to the wireless means 4 extends adjacent to the portable case 3, and the induction coil 18 and speaker S are included in the portable case 3. The wireless means used in this embodiment may be conventional AF receiver or the like.

The portion corresponding to the ear mic of the portable case may be shielded with a sound passage 9 provided around the ear mic EM. In the transmitting line A-2 the outputs of the

115 ear mic EM are amplified, FM-modulated and directly transmitted to the exterior by the transmitter T.

In the receiving line B-3 the signals transmitted from outside and received by the receiver R are electromagnetically induced by the loop antenna 17 in the induction coil 18, amplified by the AF amplifier 12B, and then supplied as output via the speaker S.

In the embodiment shown in Figure 4, the transmitting line A-1 is the same as that of the embodiment of Figure 1 and the receiving line B-1 is the same as that of the embodiment of Figure 3. Therefore, the function of this embodiment is the same in the transmitting line A-1 as that in the embodiment of Figure 1 and the same in the

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receiving line B-3 as that in the embodiment of Figure 3.

- In the embodiment shown in Figure 5, the transmitting line A-2 is the same as that of the embodiment of Figure 3 and the receiving line B-1 is the same as that of the embodiment of Figure 1. Accordingly, the function of this embodiment is the same in the transmitting line A-2 as that in the embodiment of Figure 3 and same in the receiving line B-1 as that in the embodiment of Figure 1.

- In the embodiment shown in Figure 6, the transmitting line A-2 is same as that of the embodiment of Figure 3 and the receiving line B-2 is same as that of the embodiment of Figure 2. Accordingly, the function of this embodiment is same in the transmitting line A-2 as that in the embodiment of Figure 3 and same in the receiving line B-2 as that in the embodiment of Figure 2.

- Though the present invention has been described with reference to the embodiments shown in the accompanying drawings, the portable case 3 may be of the ear hanging type shown in Figures 7 and 10, of the external auditory canal insertion type shown in Figure 12, or maybe of helmet type, spectacles frame type, or shoulder attachment type.

CLAIMS

1. A wireless transmitting and receiving system comprising an ear microphone of vibration pick-up type for picking up bone-conducted voice signals through the external auditory canal wall of an ear microphone wearer, a portable case arranged to be disposed adjacent an ear of the wearer, and a wireless means for attachment to the body of the wearer, the device comprising a transmitting line including a transmitter for transmitting output signals of the ear microphone and being housed in the portable case, and a receiving line including a receiver for receiving signals transmitted from the outside housed in the wireless means, the transmitting and receiving lines providing wireless connection between the portable case and the wireless means, whereby communication comprising transmission and reception may be achieved through one ear of the wearer into which the ear microphone is inserted.
2. A wireless transmitting and receiving system as claimed in claim 1, wherein the transmitting further comprises a receiver for receiving signals transmitted from the transmitter and a second transmitter for transmitting to the outside signals

of the receiver, the receiver and the second transmitter being housed in the wireless means.

3. A wireless transmitting and receiving system as claimed in claim 1 or 2, wherein the receiving line comprises a transmitter for transmitting output signals of the receiver, a second receiver for receiving signals transmitted from the receiving line transmitter, and a speaker for acoustically converting the output signals of the second receiver, the receiver and the transmitter being housed in the wireless means and the second receiver and the speaker being housed in the portable case.
4. A wireless transmitting and receiving system as claimed in claim 1 or 2 wherein the receiving line comprises a speaker housed in the wireless means, the speaker serving to acoustically convert output signals of the receiver to be heard by the one ear of the wearer in which the ear microphone is inserted and by the other ear of the wearer.
5. A wireless transmitting and receiver system as claimed in claim 1, 3 or 4, wherein the transmitter housed in the portable case is arranged to transmit the output signals of the ear microphone to the exterior of the portable case.
6. A wireless transmitting and receiving system as claimed in claim 5, when dependent on claim 1 or in claim 1 or 2, wherein the receiving line comprises a loop antenna for electromagnetically inducing output signals of the receiver, an induction coil electromagnetically coupled to the loop antenna, and a speaker for acoustically converting output signals of the induction coil, the antenna being connected to the wireless means and extending adjacent to the portable case, and the induction coil and the speaker being housed in the portable case.
7. A wireless transmitting and receiving system as claimed in claim 3 or 6, wherein the ear microphone is connected through a sound tube to the portable case and sound outputs of the speaker are introduced through the sound tube to the ear microphone.
8. A wireless transmitting and receiving system as claimed in any one of the preceding claims, wherein the portable case is of ear hanging type, helmet type, external auditory canal insertion type, or spectacles frame type.
9. A wireless transmitting and receiving system substantially as herein before described with reference to and as illustrated in the accompanying drawings.